國立清華大學
National Tsing Hua University

# PME 434200 Mechanical Vibrations

## 振動學

Spring 2016

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| Instructor: | Prof. Jen-Yuan (James) Chang 張禎元 教授 | Credits: | 3 credits. |
| Class meetings: | **T1T2R2** | Office hours: | Tuesdays 17:30-18:30 |

Goal: To gain a physical and mathematical understanding of how systems vibrate. First, we will gain a better understanding of how simple systems vibrate. We will then develop an understanding of the fact that complicated systems have "modes" of vibration that behave in a very similar way to simple systems. An additional goal will be to develop an understanding of some modern analytical and experimental techniques with a team work design project for vibration reduction/isolation.

Textbook (required): Daniel J. Inman, "Engineering Vibration," 4th Edition, International Edition, Pearson Education Limited, England, 2014.

Reference: Singiresu S. Rao "Mechanical Vibrations," 5th SI Edition, Prentice Hall, Singapore, 2011.

Teaching Method: Classroom lectures will be offered in both Chinese and English with teaching materials posted in Moodle.

| Assessments: | | | |
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| | Quizzes | 25% | Approximately 45 minutes/quiz, 4 quizzes total. Closed book and notes. Missed quizzes: Notify Prof. Chang **in advance** to make up the quiz. |
| | Lab assignment | 10% | Two laboratory assignments, 4 students per group. |
| | Term project | 15% | Group project, 4 students per group. |
| | Midterm Exams | 20% | In-class individual efforts, closed book and notes |
| | Final Exam | 30% | In-class individual effort, closed book and notes. |

Schedule:

| Lecture | Topic | Book Chapters |
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| 1 | Introduction to Vibration & Fundamentals of Mechanical Vibration Phenomena | Chapter 1 |
| 2 | Newtonian Dynamics<br>Linear Mechanical System | Chapter 1 |
| 3 | Newtonian Dynamics<br>Rotational Mechanical System | Chapter 1 |
| 4 | Analytical Dynamics | Chapter 1.7, Chapter 4.7 |
| 5 | Free & Forced Vibrations of<br>Single Degree of Freedom Systems | Chapter 2, Chapter 3 |
| 6 | Solving Dynamics and Vibrations with Laplace Transform | Chapter 3.4 |
| 7 | Fourier Transform in Vibrations | Chapter 3.5 |
| 8 | Vibrations of Multi-DOF Systems | Chapter 4 |
| 9 | Forced Vibrations of Multi-DOF Systems | Chapter 4 |
| 10 | Vibration Isolation and Absorption | Chapter 5 |
| 11 | Vibrations of Distributed-Parameter Systems | Chapter 6 |
| 12 | Practical Vibration Systems | Chapter 7 |
| 13 | Vibration Measurements & Experimental Modal Analysis | Chapter 7 |
| 14 | Introduction of Finite Element Method in Vibration Analysis | Chapter 8 |

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